

Metallurgical Coal Mining in Alberta: Policy, Regulation, Research

Presentation to Members of the Coal Policy Committee

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July 13, 2021

MD of Ranchlands

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Introduction

- B. Sc Biology (2001); M. Sc Toxicology (2007)
- Professional Biologist (2007)
- Toxicologist/ Risk Assessor (2007-current)
 - Owner, Integrated Toxicology Solutions
 - Consultant (WorleyParsons, Kohn Crippen Berger)
 - Regulator (Alberta Energy Regulator)
 - Instructor (Lakeland College)



Overview

- Case Study of Alberta Policy and Regulatory Systems
 - 7 examples
- Pekisko Air Quality and Health Risk Study
- Questions

Case Study: GOA assurances of strict regulatory standards and processes which protect the environment could not be verified



Get the Facts **on Coal in Alberta**





Responsible coal development is the **lifeblood** of several Alberta communities and **employs thousands** of Alberta workers. Alberta's government is committed to developing coal **responsibly** under strict regulatory standards and processes that **protect** our air, land, water and wild species from harm. Scientists, not politicians, make the environmental decisions

4

MYTH:

Coal mines will forever change our mountain landscapes.

FACT:

Companies must adhere to strict rules around land reclamation and environmental effects. Our majestic mountains will be protected.

6

MYTH:

Water quality and important headwaters are at risk from mining development.

FACT:

The environment remains protected by the Environmental Protection and Enhancement Act, including our treasured headwaters. Alberta's water supply is not at risk.

8

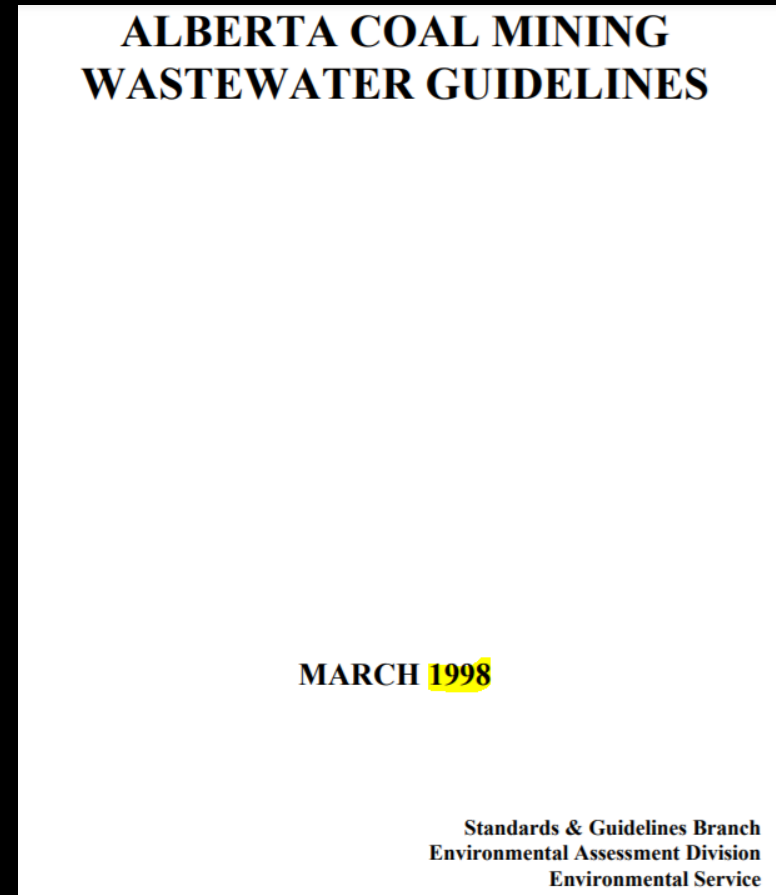
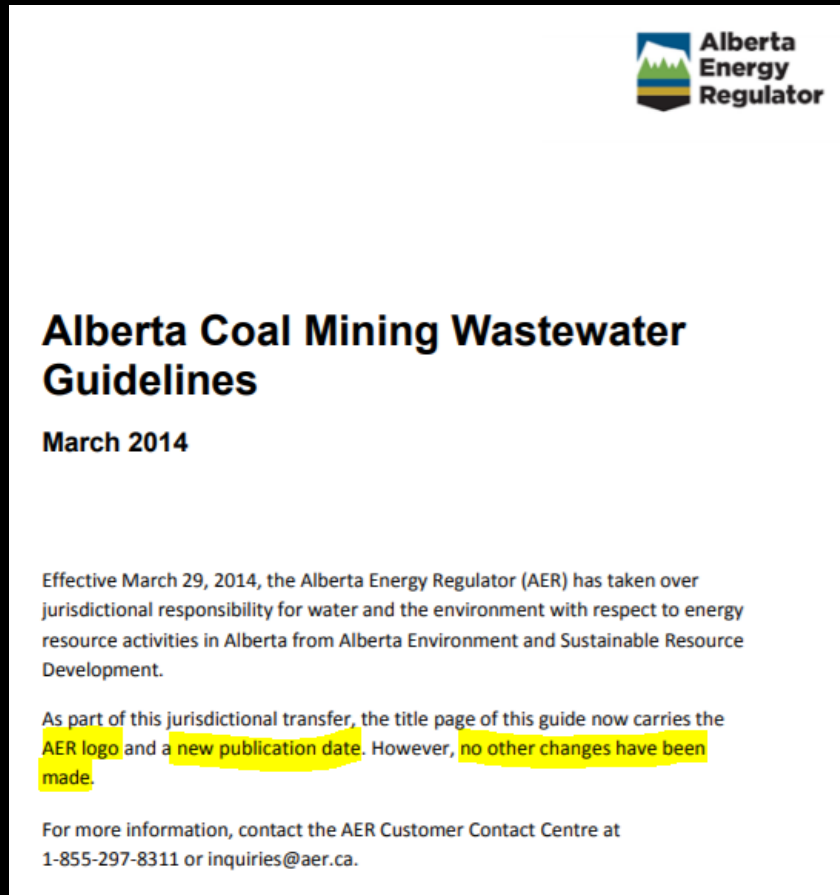
MYTH:

The 1976 Coal Policy protects water from selenium.

FACT:

Selenium is not even mentioned in the 1976 Coal Policy. The Alberta Energy Regulator is one of the best energy regulators in the entire world, and works tirelessly to ensure our water, air, land, and wild species are protected from harm.

Example 1: Outdated Policy and “lazy” Regulatory process



Example 2: Provincial Policy and Regulations cannot protect the environment from metallurgical coal mine wastewater releases



Highest risk coal mine contaminants not measured in releases

- Selenium (and other metals)
- Nutrients
- Sulphate
- Carbonate (Ca)

TABLE 1. WASTEWATER RELEASE LIMITS

Parameter	LIMITATIONS	
	Maximum Daily	Maximum Daily Average (for any month)
Total Suspended Solids (TSS)	<350 mg/L	<50 mg/L
pH	Between 6.0 to 9.5 at all times	
Floating Solids and Foam	None - except in trace amounts	
Oil and Grease	No visible sheen	

Example 3: Alberta guidelines are higher/ allow more exposure to chemicals compared to other jurisdictions across the world

  Guide	
Title:	Alberta Ambient Air Quality Objectives and Guidelines Summary
Number:	AEP, Air Policy, 2016, No. 2
Program Name:	Air Policy
Effective Date:	Differential effective dates for each objective or guideline
This document was updated on:	January, 2019

<https://open.alberta.ca/dataset/0d2ad470-117e-410f-ba4f-aa352cb02d4d/resource/4ddd8097-6787-43f3-bb4a-908e20f5e8f1/download/aaqo-summary-jan2019.pdf>

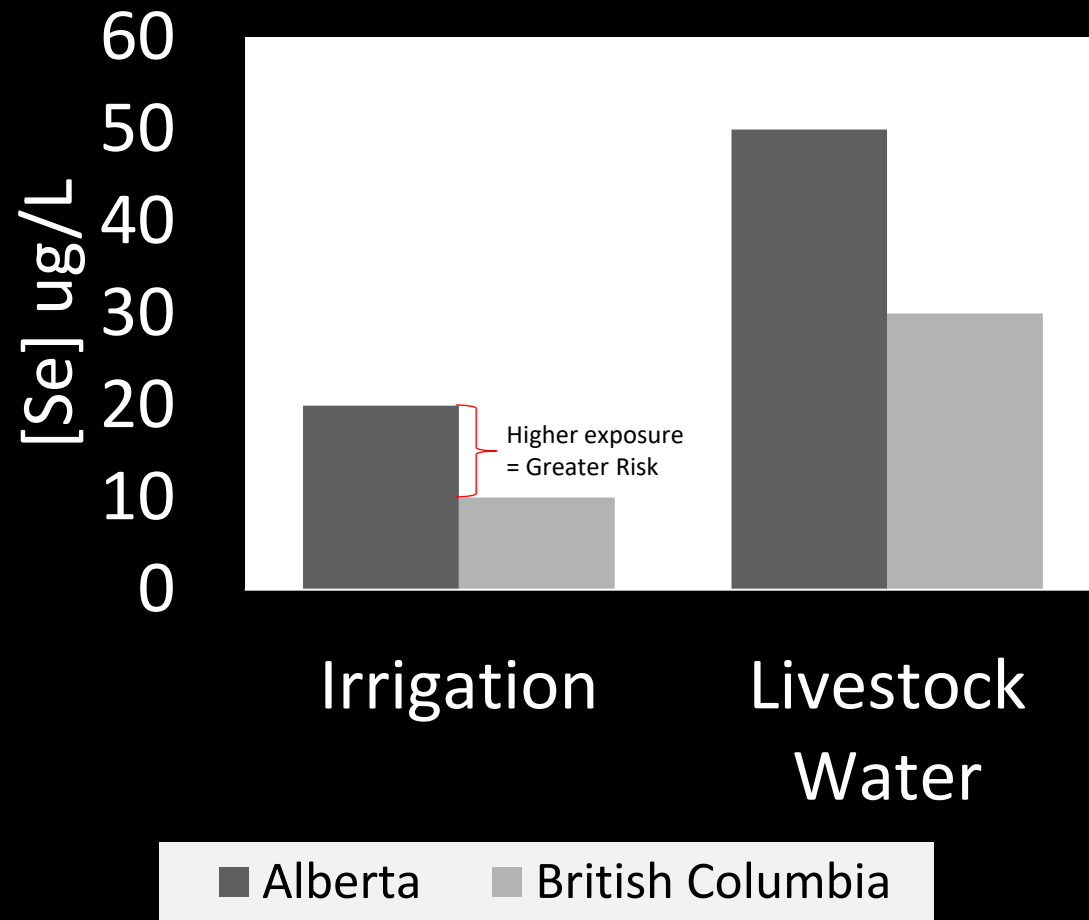


Environmental Quality Guidelines for Alberta Surface Waters

March 28, 2018

<https://open.alberta.ca/dataset/5298aadb-f5cc-4160-8620-ad139bb985d8/resource/38ed9bb1-233f-4e28-b344-808670b20dae/download/environmentalqualitysurfacewaters-mar28-2018.pdf>

Selenium – Agricultural Water Use



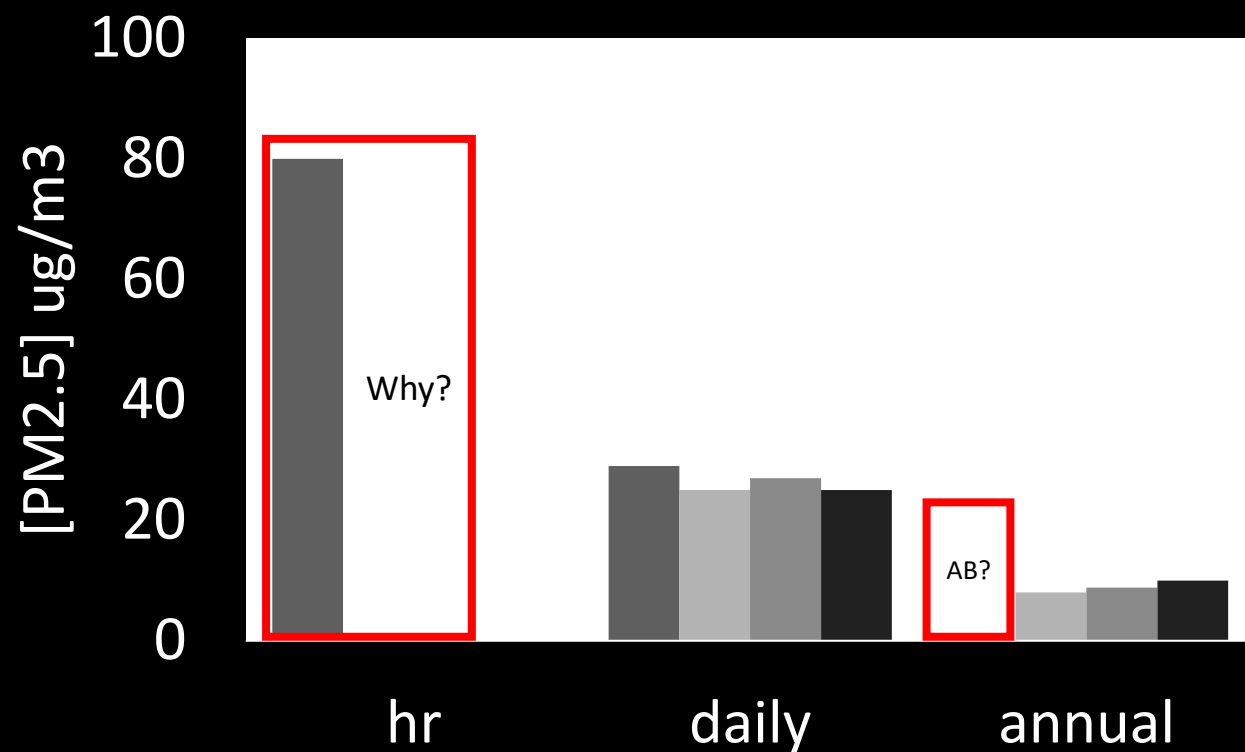
Low concentrations = Essential nutrient for reproduction, immunity, thyroid function

Biomagnifies - [4000x] higher in animals

High concentrations = Toxicity
Hair loss, hoof malformations, blind staggers, increased aborted/ still born calves, decreased immunity

Hayes, D.P., 2007. Nutritional hormesis. *European journal of clinical nutrition*, 61(2), pp.147-159
<https://www.merckvetmanual.com/toxicology/selenium-toxicosis/overview-of-selenium-toxicosis>
Yaeger, M.J., Neiger, R.D., Holler, L., Fraser, T.L., Hurley, D.J. and Palmer, I.S., 1998. The effect of subclinical selenium toxicosis on pregnant beef cattle. *Journal of Veterinary diagnostic investigation*, 10(3), pp.268-273.

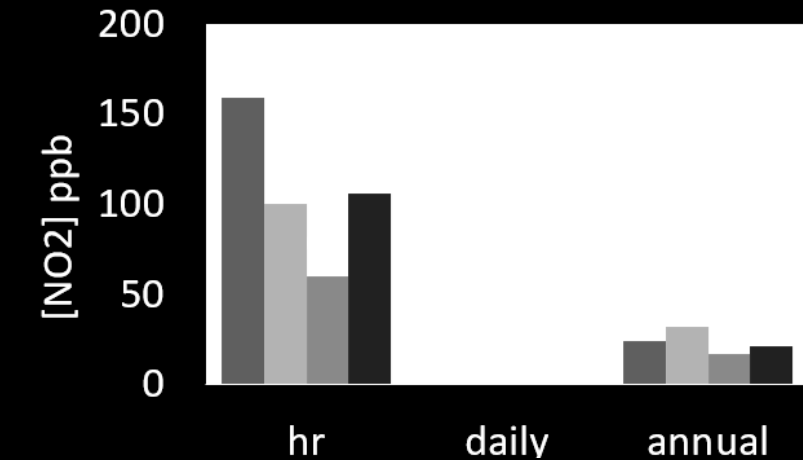
Air Quality – Particulate Matter



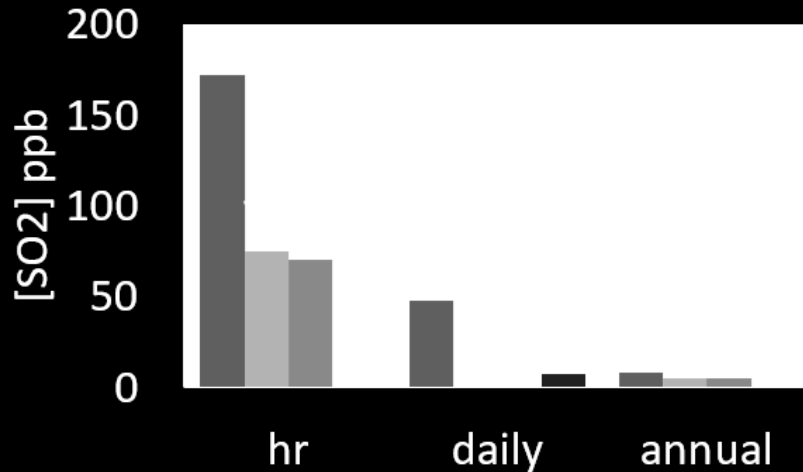
There is good evidence of the effects of short-term exposure to PM₁₀ on respiratory health, but for mortality, and especially as a consequence of long-term exposure, PM_{2.5} is a stronger risk factor than the coarse part of PM₁₀ (particles in the 2.5–10 μm range). All-cause daily mortality is estimated to increase by 0.2–0.6% per 10 $\mu\text{g}/\text{m}^3$ of PM₁₀ (6,7). Long-term exposure to PM_{2.5} is associated with an increase in the long-term risk of cardiopulmonary mortality by 6–13% per 10 $\mu\text{g}/\text{m}^3$ of PM_{2.5} (8–10).

- Alberta
- British Columbia
- Canada
- World Health Organization

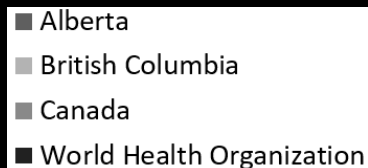
Air Quality – Sulphur and nitrogen dioxide



Short term (hourly) = human health protection



Long term (annual) = environmental health protection



Example 4: Alberta cumulative effects management and Land Use Planning under South Saskatchewan Regional Plan (SSRP) is incomplete and lacks transparent, complete and timely reporting.

- Most recent status report (2016)
 - 22% complete
 - 30% deferred
 - 48% in progress
- 2 of 5 proposed management frameworks released
 - Air Quality
 - Surface Water Quality

Provincial Outcome: Healthy ecosystems and environment		
SSRP Outcome 2: Air quality is managed to support healthy ecosystems and human needs through shared stewardship.		
Implement the South Saskatchewan Region Air Quality Management Framework	Environment and Parks	Completed
SSRP Outcome 3: Biodiversity and ecosystem function are sustained through shared stewardship.		
Complete the South Saskatchewan Region Biodiversity Management Framework	Environment and Parks	Due 2015; deferred to 2018

SSRP Surface Water Quality Management

- No triggers or limits for key contaminants associated with coal mining:
 - Selenium (or other metals)
 - Calcium carbonate or calcite

Table 7: Ambient Surface Water Quality Triggers and Limits for the Oldman River at Brocket.

Indicator	Surface Water Quality Triggers				Surface Water Quality Limit
	Open Water (April to Oct.)		Winter (Nov. to March)		
	Median	90th Percentile	Median	90th Percentile	
Total Ammonia (NH ₃₊₄ -N) mg/L	0.025	0.060	0.025	0.039	Varies with pH and temperature ^{a, c}
Chloride (Cl ⁻) mg/L	0.9	1.8	1.2	1.9	100 ^{b, c}
Nitrate (NO ₃ -N) mg/L	0.078	0.128	0.092	0.132	3.0 ^{a, c}
Total Nitrogen (TN) mg/L	0.23	0.35	0.19	0.32	-
Total Dissolved Phosphorus (TDP) mg/L	0.003	0.006	0.003	0.005	-
Total Phosphorus (TP) mg/L	0.007	0.018	0.005	0.010	-
Sulphate (SO ₄ ⁻) mg/L	22.1	29.4	29.6	36.0	Varies with Hardness ^c
Sodium Adsorption Ratio (SAR)	0.16	0.22	0.18	0.20	5 ^{c, d}
Specific Conductivity µS/cm	276	313	308	342	1000 ^{c, d}
Total Dissolved Solids mg/L	156	181	179	202	500 ^{b, c}
Total Organic Carbon mg/L	2.0	3.7	1.6	2.2	-
Total Suspended Solids mg/L	3	10	1	6	-
Turbidity NTU	4.5	18.8	2.3	8.5	-
pH	8.26	8.35	8.26	8.34	<6.5 or >9.0 ^{a, c}
<i>Escherichia coli</i> cfu per 100 mL	3	14	2	27	100 ^{b, c}

a CCME Guidelines for the Protection of Aquatic Life

b CCME Guidelines for the Protection of Agricultural Water Uses – Irrigation Use

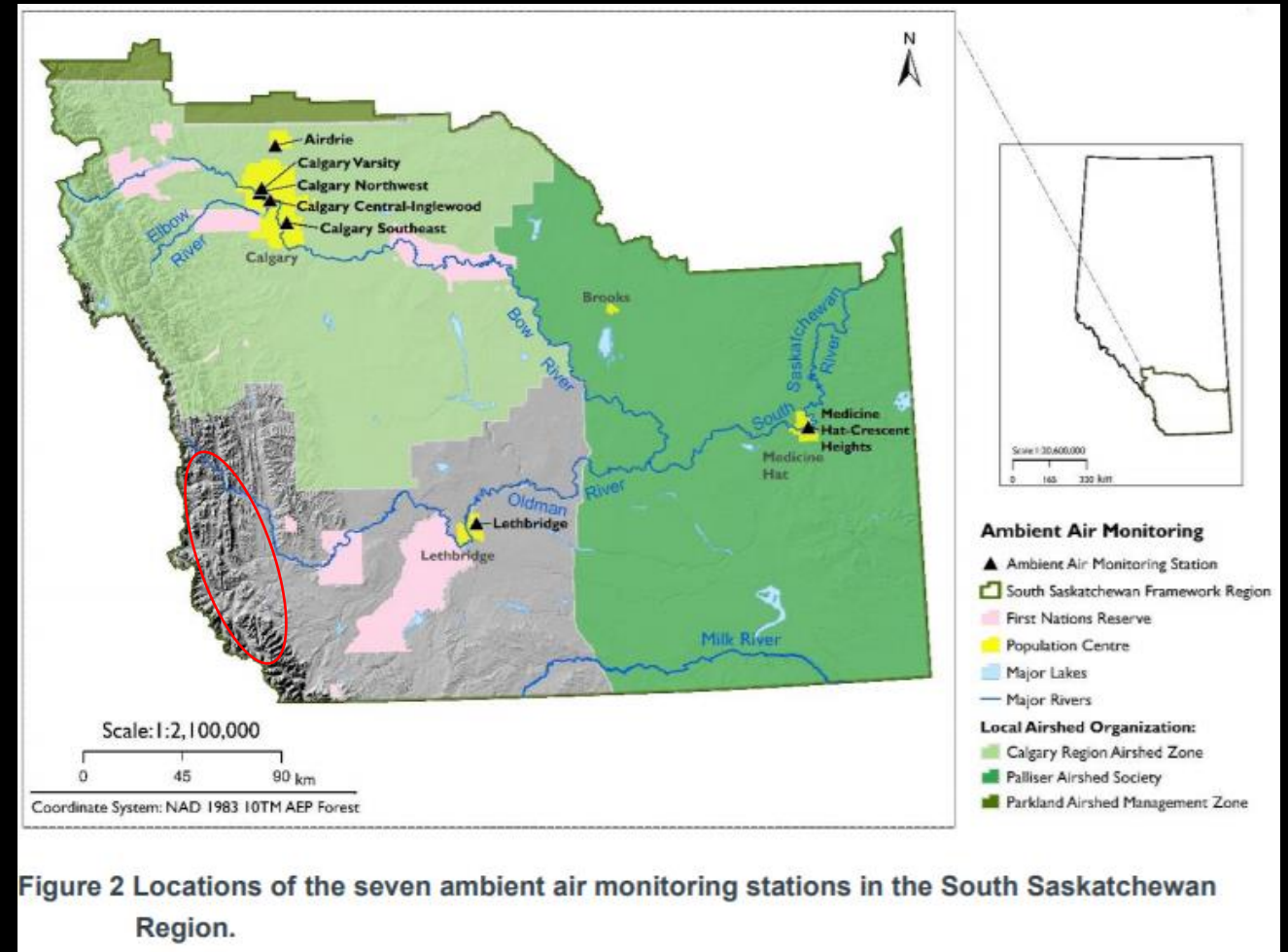
c Environmental Quality Guidelines for Alberta Surface Waters

d Alberta Agriculture and Rural Development 2002 fact sheet : "Salinity and Sodicty Guideline for Irrigation Water"- Note that the guideline is a combination of SAR and specific conductivity values.

mg/L = milligram per litre; µS/cm = microsiemens per centimetre; NTU = Nephelometric Turbidity Unit; cfu = colony forming units

SSRP Air Quality Management

- 3 parameters: NO₂, PM_{2.5}, Ozone
- No air quality monitoring in Livingstone area
 - may be due to low industrial development (i.e. pristine condition)
- Most recent Provincial status report (2018):
 - Indicates all 3 parameters require management in cities



Thi, A. 2020. 2018 Status of Air Quality, South Saskatchewan Region, Alberta. Government of Alberta, Ministry of Environment and Parks. ISBN 978-1-4601-4894-5. Available at: <https://open.alberta.ca/publications/status-of-air-quality-south-saskatchewan-region-alberta>.

Example 5: Regulatory oversight has allowed consistent non-compliance with regulatory approvals resulting in significant impacts to the environment

- Surface Water Quality - Selenium
- Wildlife populations - Harlequin ducks
- Groundwater quality
- Air Quality

Water Quality - Selenium

Selenium Summary Report

Cardinal River Operations
March 2020

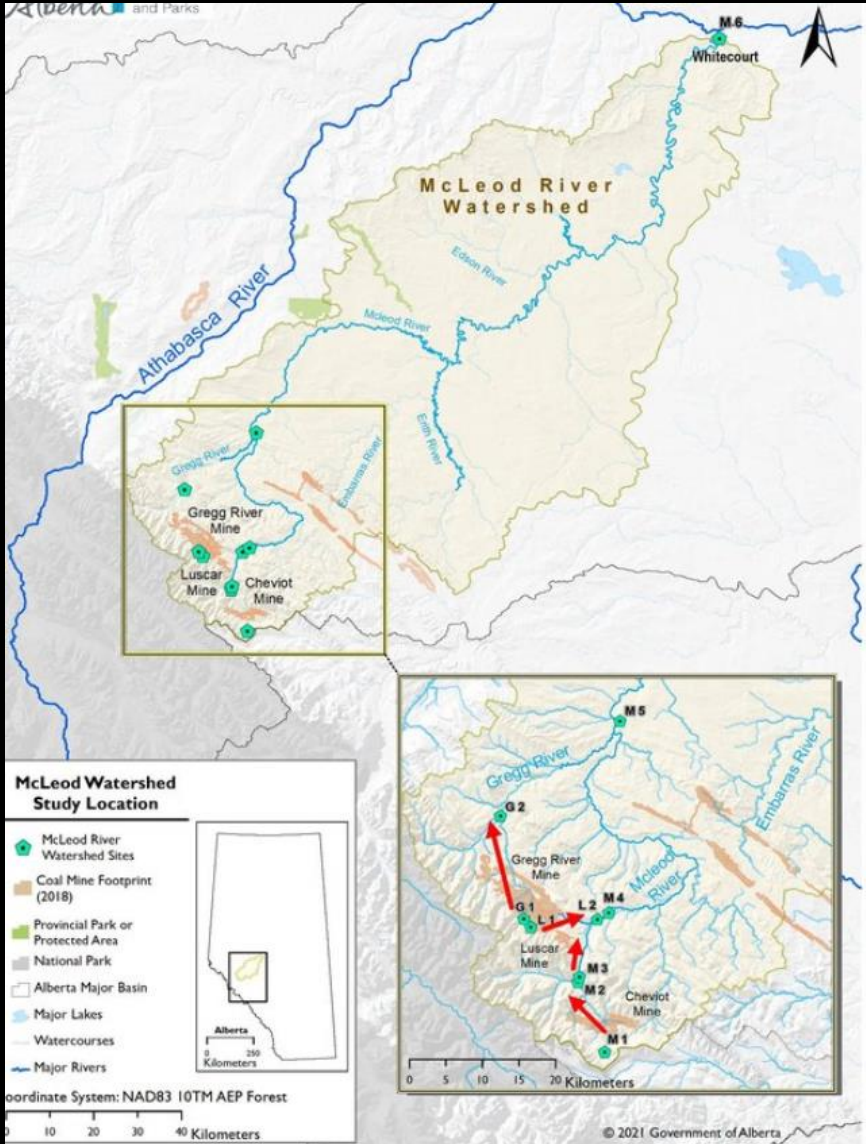


Table 2.0 – Selenium Concentration Averages, Medians and 90th Percentiles

	MR1				MR2				MR4				MR6			
Five Year Avg. Selenium concentrations (µg/L)																
	N	Avg	50th	90th	N	Avg	50th	90th	N	Avg	50th	90th	N	Avg	50th	90th
2006	4	0.55	0.30	110	10	0.78	0.60	134	9	0.82	0.70	124	9	4.27	4.70	6.02
2007	3	0.82	0.40	144	6	123	0.65	2.85	2	115	115	127	3	5.17	5.10	5.34
2008	5	0.34	0.20	0.62	7	111	0.90	2.16	5	0.61	0.63	0.94	9	5.03	3.90	7.24
2009	6	0.70	0.50	136	9	135	0.80	2.52	6	115	107	181	5	4.62	5.24	6.45
2010	8	0.19	0.20	0.30	12	2.63	2.82	4.15	12	113	113	154	12	3.59	3.28	6.44
5-yr	26	0.46	0.30	131	44	1.51	0.90	3.39	34	0.98	100	150	38	4.35	4.60	6.24
Three Year (2011 - 2013) Selenium Concentrations (µg/L)																
2011	6	0.20	0.20	0.20	12	2.73	2.87	3.78	12	108	109	136	12	3.86	3.07	6.25
2012	9	0.43	0.30	0.64	12	4.86	3.93	8.59	11	191	168	3.21	12	4.04	3.93	5.54
2013	10	0.28	0.25	0.35	12	2.82	2.46	5.24	12	164	144	2.62	12	4.38	3.33	7.45
3-yr	25	0.32	0.25	0.39	36	3.47	2.93	7.27	35	154	135	2.67	36	4.23	4.03	6.56
Three Year (2014-2016) Annual Selenium Concentrations (µg/L)																
2014	12	0.29	0.27	0.40	12	130	115	2.10	12	119	112	163	11	2.95	2.74	4.04
2015	12	0.34	0.34	0.40	12	162	155	2.50	12	135	132	177	12	2.98	2.51	5.32
2016	12	0.33	0.34	0.42	12	155	146	2.06	12	151	150	2.02	12	3.43	3.72	4.68
3-yr	36	0.32	0.34	0.42	36	149	137	2.20	36	135	129	196	35	3.13	3.06	4.69
Three Year (2017-2019) Annual Selenium Concentrations (µg/L)																
2017	12	0.37	0.34	0.49	12	2.32	2.29	3.39	12	156	163	2.38	12	3.27	3.39	4.92
2018	12	0.41	0.43	0.50	12	4.05	4.40	5.57	12	2.12	197	3.78	12	3.94	4.55	5.25
2019	12	0.40	0.39	0.54	12	4.23	3.23	7.46	12	187	165	2.98	12	4.44	4.63	6.46
3-yr	36	0.39	0.39	0.51	36	3.53	3.31	5.47	36	1.85	175	3.05	36	3.88	4.19	5.54
Trend (vs 5-yr)	---	Decrease	Increase	Decrease	---	Increase	Increase	Increase	---	Increase	Increase	Increase	---	Decrease	Decrease	Decrease

Redmond, L.E. 2021. Water quality in the McLeod River as an indicator for mining impacts and reclamation success (2005 to 2016). Government of Alberta, Ministry of Environment and Parks. ISBN 978-1-4601-4982-9. Available at: <http://open.alberta.ca/>

Compliant

Non-compliant

Increasing 5 year trends

Government study contradicts industry reports

Nutrient and metal concentrations at 5 Monitoring Sites

- 29 trends detected
- **86% increasing**
- 14% decreasing

Redmond, L.E. 2021. Water quality in the McLeod River as an indicator for mining impacts and **reclamation success** (2005 to 2016).

Table 4: Trend analysis results for nutrient parameters at sites along the McLeod River from 2005-2016. Raw or flow adjusted trends indicated.

Site	M1		M2		M3	M5	M6
	Raw	Flow adjusted	Raw	Flow adjusted	Raw	Raw	Raw
Dissolved Ammonia	-Not assessed-	-Not assessed-	No trend	BDL	No trend	No trend	No trend
Dissolved Organic Carbon	No trend	No trend	No trend	No trend	No trend	No trend	No trend
Dissolved Nitrogen NO3 + NO2	No trend	BDL	Increasing*	Increasing*	Increasing*	No trend	-Not assessed-
Total Kjeldahl Nitrogen (TKN)	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Phosphorus	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Dissolved Phosphorus	No trend	BDL	No trend	BDL	No trend	No trend	No trend

*Statistically significant (p-value <0.05).

BDL= Below Detection Limit; no flow adjusted trends were completed for parameters with censored data.

Table 5: Trend analysis results for metal parameters at sites along the McLeod River from 2005-2016. Raw or flow adjusted trends indicated.

Site	M1		M2		M3	M5	M6
	Raw	Flow adjusted	Raw	Flow adjusted	Raw	Raw	Raw
Total Aluminum	No trend	No trend	No trend	No trend	No trend	No trend	No trend
Total Antimony	No trend	No trend	Increasing*	Increasing*	Increasing*	No trend	No trend
Total Arsenic	No trend	BDL	Increasing*	Increasing*	Increasing*	No trend	No trend
Total Barium	No trend	No trend	No trend	Decreasing*	No trend	No trend	No trend
Total Beryllium	Increasing*	BDL	No trend	BDL	No trend	No trend	No trend
Total Bismuth	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Boron	Increasing*	Increasing*	Increasing*	Increasing*	No trend	Increasing*	Increasing*
Total Cadmium	No trend	BDL	Increasing*	Increasing*	No trend	No trend	No trend
Total Chromium	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Cobalt	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Copper	No trend	No trend	No trend	No trend	No trend	No trend	No trend
Total Iron	Increasing*	BDL	No trend	BDL	No trend	No trend	No trend
Total Lead	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Lithium	No trend	No trend	Increasing*	Increasing*	Increasing*	Increasing*	No trend
Total Manganese	No trend	BDL	No trend	No trend	No trend	No trend	No trend
Total Molybdenum	No trend	No trend	Increasing*	Increasing*	Increasing*	No trend	Increasing*
Total Nickel	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Selenium	No trend	BDL	Increasing*	Increasing*	Increasing*	No trend	No trend
Total Silver	Increasing*	BDL	Increasing*	BDL	Increasing*	No trend	No trend
Total Strontium	Decreasing*	No trend	No trend	Increasing*	No trend	Increasing*	No trend
Total Thallium	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Thorium	No trend	BDL	No trend	BDL	No trend	No trend	No trend
Total Tin	Decreasing*	BDL	No trend	BDL	Decreasing*	Decreasing*	No trend
Total Titanium	No trend	No trend	No trend	No trend	No trend	No trend	No trend
Total Uranium	No trend	Decreasing*	Increasing*	Increasing*	Increasing*	Increasing*	No trend
Total Vanadium	No trend	BDL	No trend	No trend	No trend	No trend	No trend
Total Zinc	Decreasing*	BDL	Increasing*	No trend	No trend	No trend	No trend

*Statistically significant (p-value <0.05).

BDL= Below Detection Limit; no flow adjusted trends were completed for parameters with censored data.

Harlequin Ducks

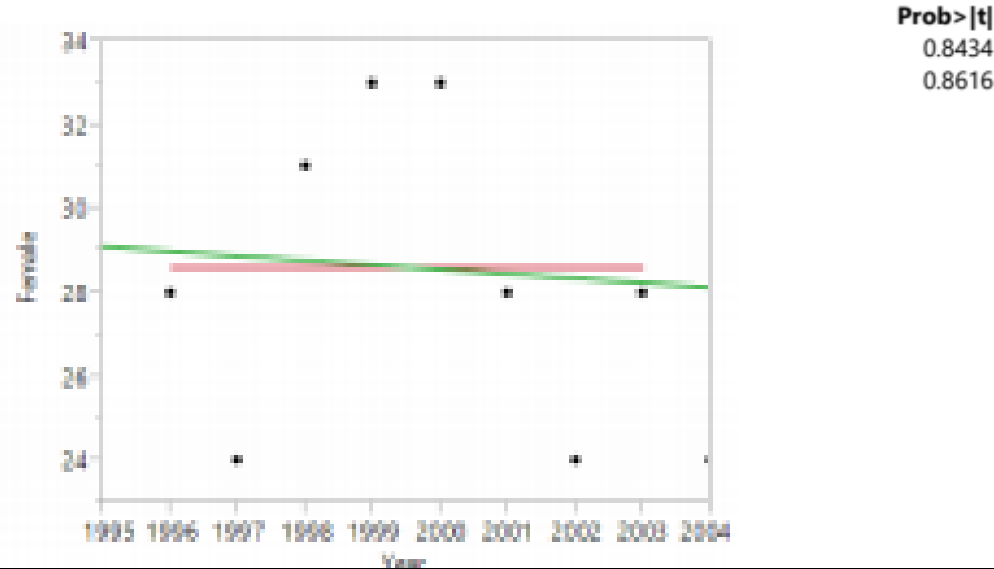
Report Title:	Harlequin Duck Study Cheviot 2019
Authors:	B. MacCallum, Bighorn Wildlife Technologies Ltd.
GIS:	A. Paquet, Bighorn Wildlife Technologies Ltd.
Front Cover:	A. Godsolve, Bighorn Wildlife Technologies Ltd.
Date:	April 20, 2020

2.3 Population Trend

A regression of the number of female Harlequin Ducks in the McLeod watershed against year between 1996 and 2019 produced an estimate of -0.54 (se 0.13) females/year ($P = 0.0003$, CI = -0.81 to -0.28) a significant decline over the 24-year period (Figure 3, Appendix II). Male harlequins declined during the same time by -0.84 (se 0.16) males/year ($P = <.0001$, CI = -1.17 to -0.51).

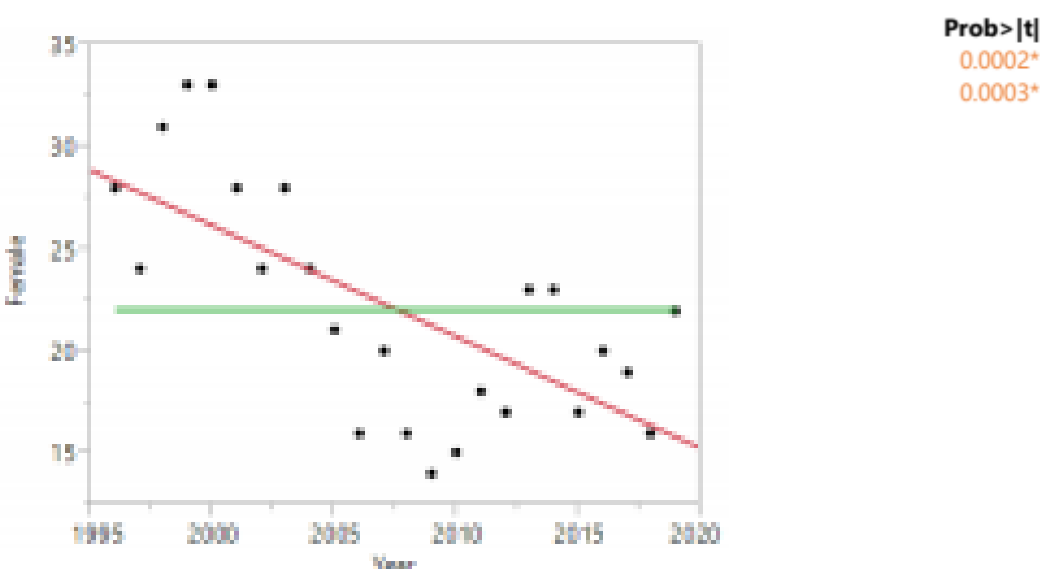
APPENDIX II Time Trend Regression for Female, Male and Hatch Year Harlequin Ducks 1996 to 2019

Bivariate Fit of Females by Year 1996 to 2003



Pre/ early mining

Bivariate Fit of Females by Year 1996 to 2019



Pre/ early mining – operating phase

Groundwater Quality

Table 4-2 Cheviot Mine Area 2019 Summary of CCME Exceedances

Parameter	CCME Guideline	Well ID	N _x	N _{total}	N _{Cheviot}	Min	Max	Avg
						mg/L		
Nitrate (as N)	13 mg/L	CV_15-02	1	1	137	31	31	31
Selenium (Se)	1.0 ug/L	CV_15-01	1	1	100	0.00148	0.00148	0.00148
		CV_TH18	23	31		0.0019	0.00755	0.00505
		CV_THWW-0804	43	60		0.0019	0.00876	0.00412
Copper (Cu)	0.0005 mg/L	CV_15-01	1	1	79	0.00574	0.00574	0.00574
		CV_THWW-0804	1	48		0.00393	0.00393	0.00393
Iron (Fe)	0.01 mg/L	CV_15-01	1	1	79	2.53	2.53	2.53
		CV_THWW-0804	1	48		1.32	1.73	1.53
Lead (Pb)	0.00005 mg/L	CV_15-01	1	1	50	0.00166	0.00166	0.00166

N_x indicates number of exceedances from the well, N_{total} indicates total sample size from the well, and N_{Cheviot} indicates total number of samples analyzed from all the Cheviot wells. *Total metals were included in the analysis for discharging wells.

Exceeding Alberta Groundwater Quality Guideline

6 RESPONSES TO ALBERTA GOVERNMENT ON 2017 GROUNDWATER MONITORING REPORT

There were no comments from Alberta Environment and Parks (AEP) and/or Alberta Energy Regulator (AER) on the 2017 groundwater monitoring summary report.

Air Quality

Cardinal River Operations

2019 Annual Report - Cheviot Mine

July, 2020

Table 2 Summary Statistics for all 5 Sites Compared to Residential/Recreational Guideline

Summary Statistics	Total Dustfall (mg/ 100 cm ² / 30 days)
Count	60
Average	72
Minimum	11
Maximum	550
# of Exceedances	24
Compliance %	60

Example 6: Alberta has accrued over \$250 billion in liability/ environmental contamination from development of energy resources under “strict” Provincial Policy and Regulations



Liability Challenges
Robert Wadsworth, Vice President,
Closure & Liability
February 28, 2018



Best Practices Assessment

Regulatory Mechanism	Alberta & British Columbia	Texas	New Mexico
Timelines for abandonment	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Well-specific security deposit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Application for inactive / temporary abandonment status	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Trend	increasing population trend	Static population trend	Declining population trend

Example 7: Alberta Mine Financial Security Program (MFSP) and securities held by Province can be affected by market prices and industry lobbying

Impact of 2020

Extremely low oil prices in 2020 reinforced problems with the MFSP formula. The program was never designed for a drastic swing in oil prices that the oil sector experienced in 2020. A year ago, the price of West Texas Intermediate reached a historical minimum of –US\$37 per barrel and it is currently more than US\$60 per barrel.

While the price of oil has already begun to recover, the extremely low oil prices in 2020 skewed the calculation of what oil sands companies would have been required to pay for reclamation security in 2021.

As a result, the Government of Alberta is making a change in the interim to the calculation while the review is underway, to ensure security amounts align with the intent of the program.

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2019 Coal Mines

As of September 30, 2020, the total cash deposits and letter of credit guarantees for coal mines held in the security fund under the MFSP amounted \$546 998 910, compared with \$533 782 702 for September 2019. For additional information, please see below:

EPEA approval holder	Project name	EPEA approval number	Financial security amount
Prairie Mines and Royalty ULC	Paintearth & Vesta Mine	11364	\$12 792 752
Prairie Mines and Royalty ULC	Sheerness & Montgomery Mine	11876	\$15 930 486
Prairie Mines and Royalty ULC.	Coal Valley Mine	11066	\$73 798 969
Prairie Mines and Royalty ULC	Obed Coal Mine	10119	\$44 582 560
Prairie Mines and Royalty ULC	Gregg River Coal Mine	11903	\$1 780 124
Prairie Mines and Royalty ULC	Tent Mountain No. 3 Mine Coleman Plantsite	75621	\$382 035
Montem Resources Alberta Operations Ltd.	Tent Mountain Coal Mine	47679	\$138 042
CST Canada Coal Limited	Grande Cache Coal Mine	155804	\$31 552 458
TransAlta Corporation	Whitewood Coal Mine	11851	\$1 283 400
TransAlta Corporation	Highvale Coal Mine	11187	\$130 073 000
Dodds Coal Mining Company Ltd.	Dodds Coal Mine and Handling Facility	220226	\$323 984
Dodds Coal Mining Company Ltd.	Dodds Reclamation	69353	\$28 528
Mancal Coal Inc.	Kipp Coal Mine Reclamation	11893	\$123 349
Cardinal River Coals Ltd.	Luscar Coal Mine	11767	\$88 998 003
Cardinal River Coals Ltd.	Cheviot Coal Mine	46972	\$85 986 526
Capital Power GP Holdings Inc.	Genesee Coal Mine	10404	\$51 972 273
Whissell Land Corporation	Burtonsville Island Coal Mine	194463	\$252 421
Coalspur Mines (Operations) Ltd.	Vista Coal Mine	301345	\$7 000 000
Total			\$546 998 910

Conclusions

- Economic pressures drive and impact Alberta Policy and Regulatory system
- Well documented environmental contamination occurring under Alberta policy and regulatory oversight
 - Environmental contamination from development
 - Liability estimated at \$260 million
- Compared to other jurisdictions, Alberta Policy and guidelines are not:
 - “strict”
 - “best”
 - “world class”
 - “determined by scientists”
- This may be the cost of doing business but the Alberta Regulatory system is not:
 - Effective/ robust
 - World class
 - Risk-based
 - Balanced

Predictive Air Quality and Health Risk Study of Proposed Metallurgical Coal Mining in the Livingstone Area

Funding : Pekisko Group

Lead Researcher: Mandy Olsgard

Teck Elk Valley

- Dust management and air quality monitoring is required
- Sparwood residents compensated
- 241 public complaints
 - Odours
 - Nuisance dust
 - Visibility
 - Health effects



Airborne dust has been an ongoing concern in Sparwood. File photo

Teck to compensate Sparwood residents for dust

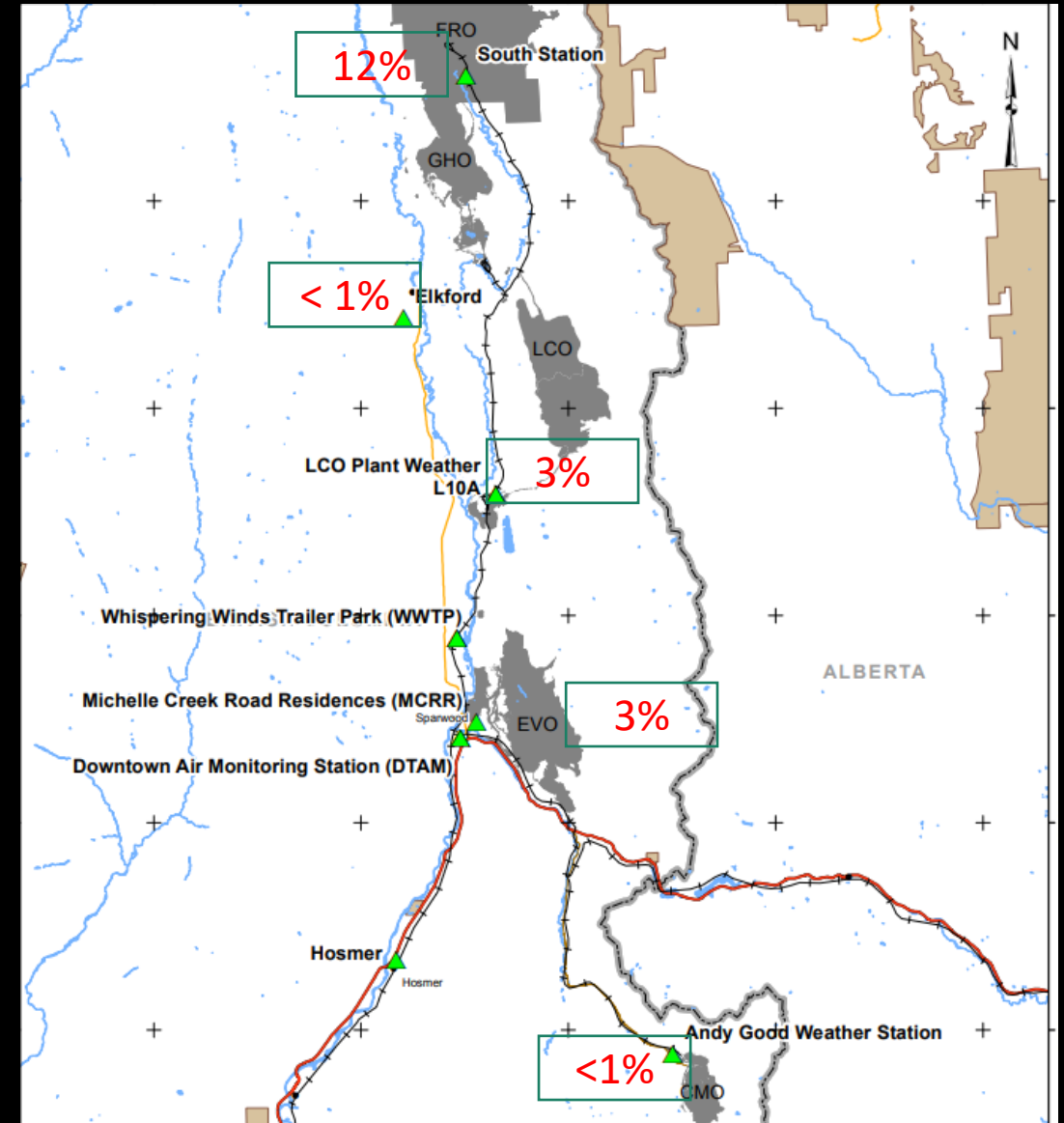
House cleaning among mitigation measures pitched by focus group; plus former Mayor joins SCEEAC

[KIMBERLEY VLASIC](#) / Mar. 23, 2019 3:30 p.m. / [LOCAL NEWS](#) / [NEWS](#)

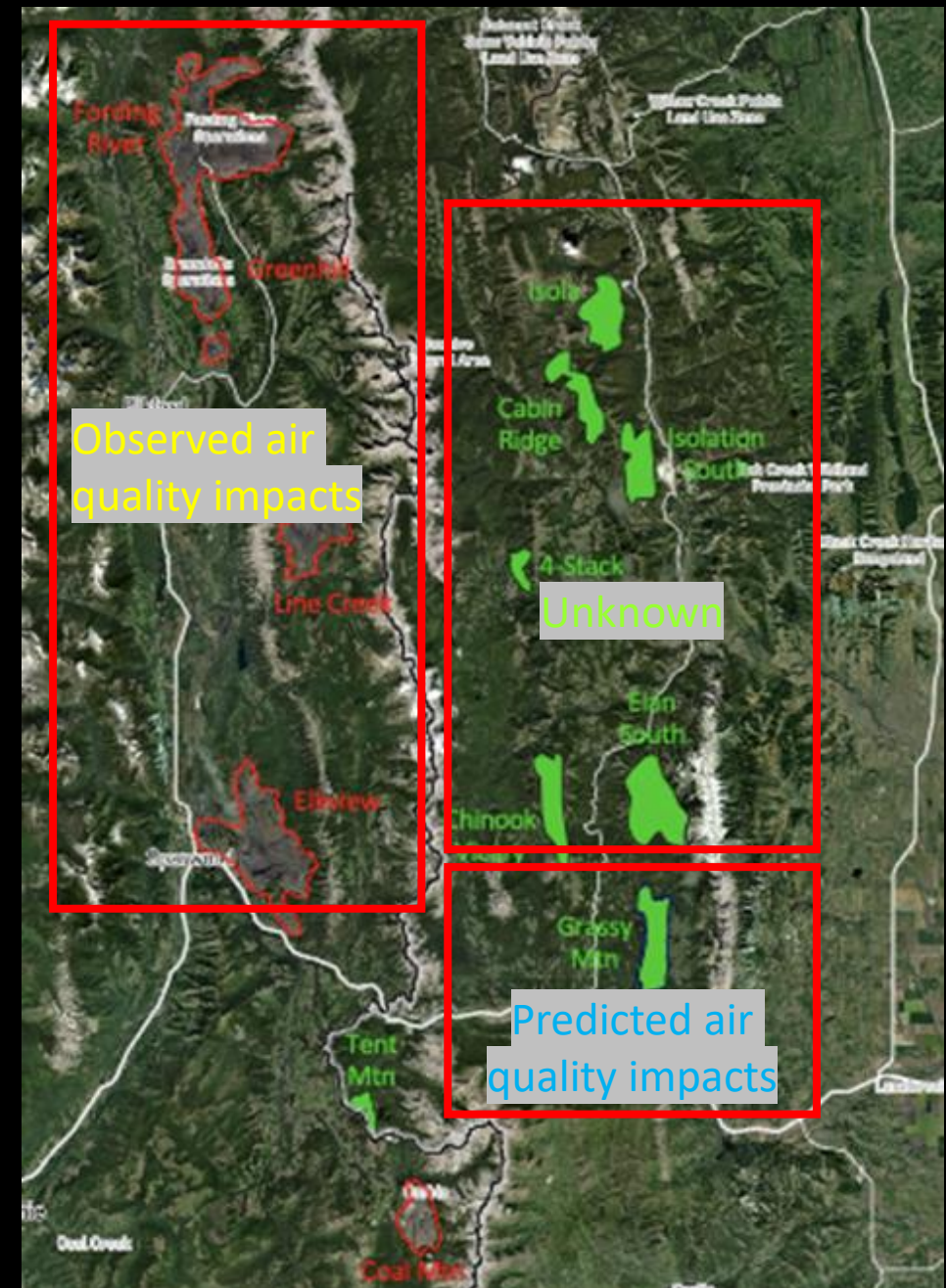
Teck Elk Valley

- Exceedances of BC Air Quality Objectives
 - Particulate matter (PM)
 - Sulphur dioxide (SO₂)

Maximum frequency of particulate matter exceedances by station

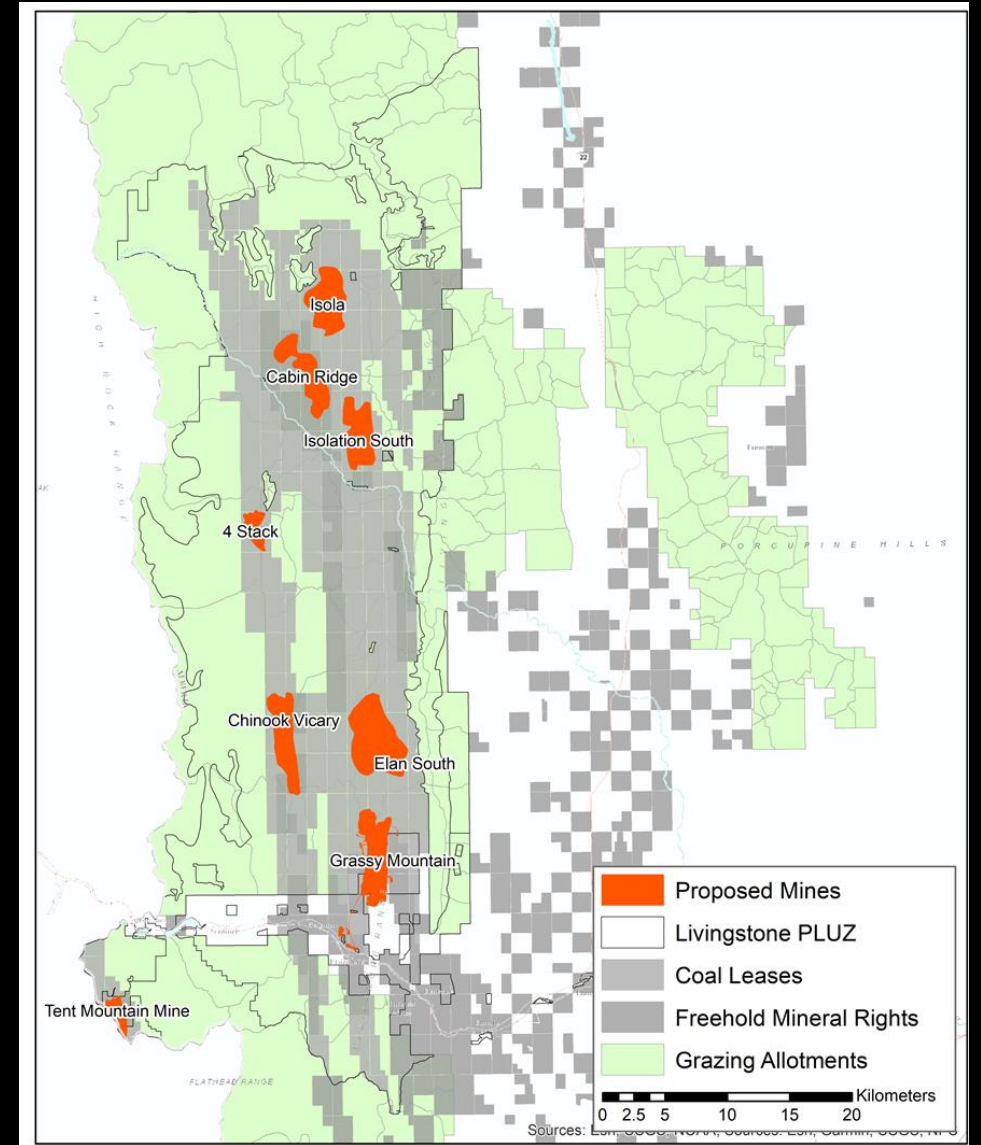


Cumulative Impacts from Development of Coal Leases?



Study Rationale

- Multiple Land Use permits issued
 - Forestry
 - Grazing Allotments
 - Irrigation
 - Coal
- Policy and regulatory gaps
- Potential for eight mines in small land use area
 - No baseline environmental data
 - No cumulative effects assessment
- Documented impacts to air quality from coal mining
- Health and economic concerns from local residents, ranchers, farmers



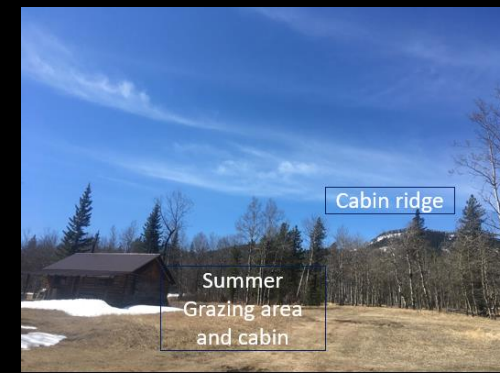
Goal

Assess potential health risks from exposure to air contaminants released from metallurgical coal mining:

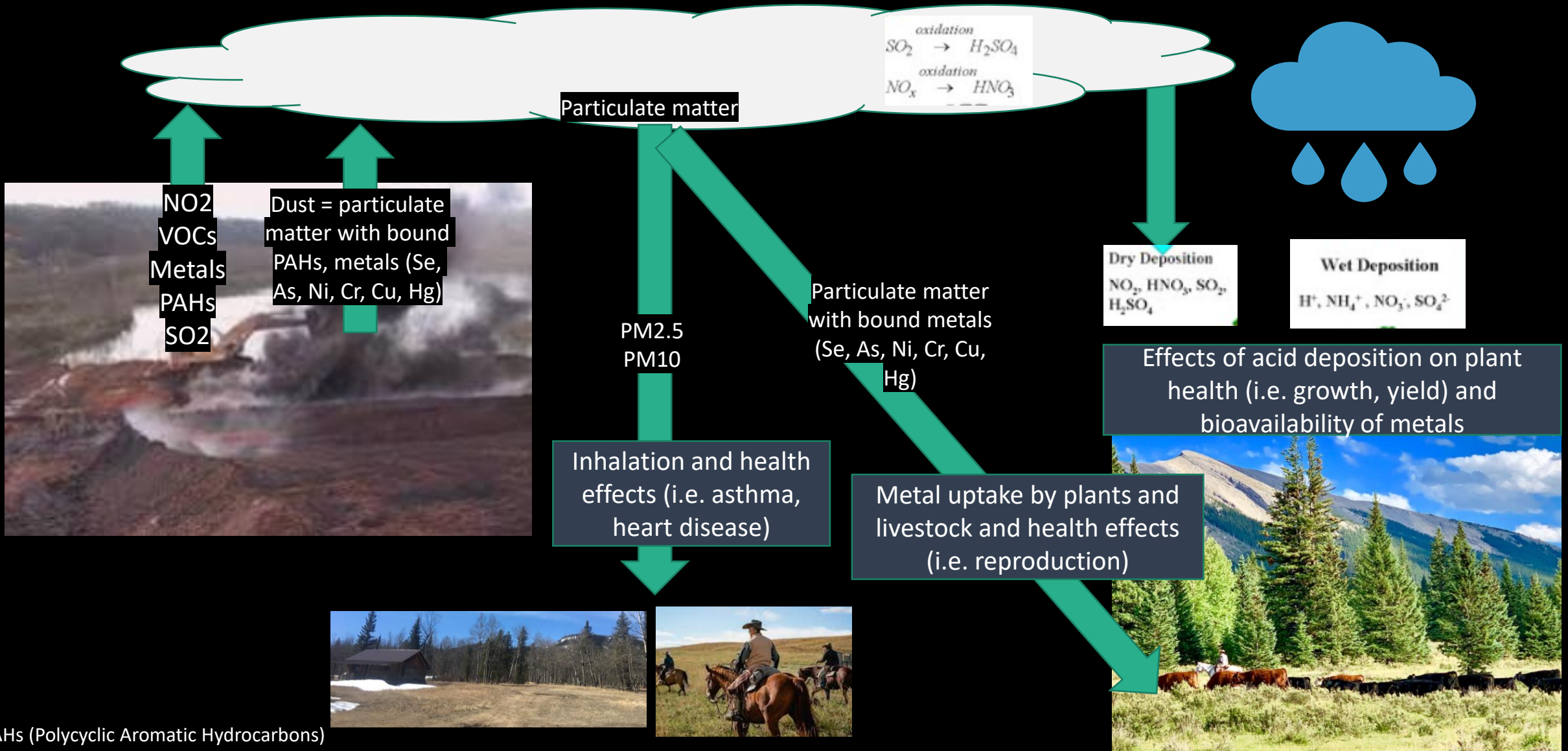
- Residents
- Livestock
- Grazing pasture
- Fish/ Surface water quality



Land Uses in SSR Chart	
Conservation management areas on public lands	11.4%
Agriculture <ul style="list-style-type: none">• cultivated• grazing	67.2% <ul style="list-style-type: none">• 40.5%• 26.7%
Forestry	6.2%
Recreation/tourism on Public Lands	0.5%
Urban Centres	1.9%
Parks and Protected Areas (PPAs)	6.1%
Military	2.6%
First Nations Reserves	4.1%



Conceptual Site Model – Study Design



PAHs (Polycyclic Aromatic Hydrocarbons)
VOCs (Volatile Organic Compounds)

Methods:

Step 1: Air Dispersion Model (CALPUFF)

Sources of
chemicals

Meteorology

Receptors

Predicted
concentrations/
deposition

Step 2: Risk Assessment

Estimate uptake by
plants

Compare
to safe
exposure
levels

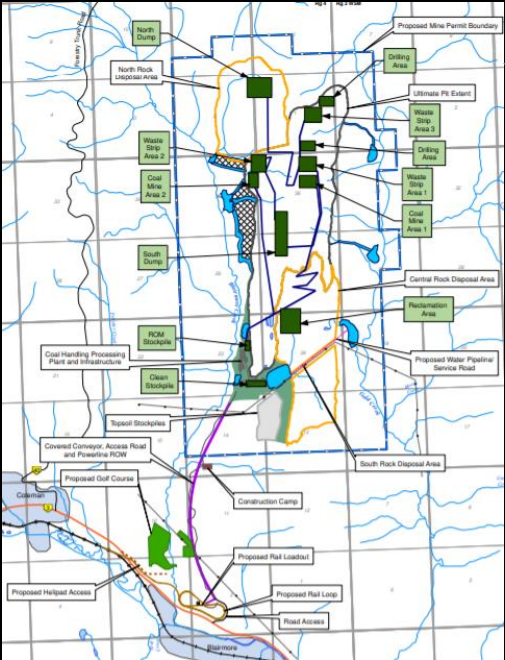
Estimate uptake by
livestock

Compare to
agricultural
guidelines

Compare to human
health guidelines

Compare to
environmental
health guidelines

Creating the Cumulative Mine Scenario



Step 1: Replicate Grassy Mountain Mine CALPUFF Model

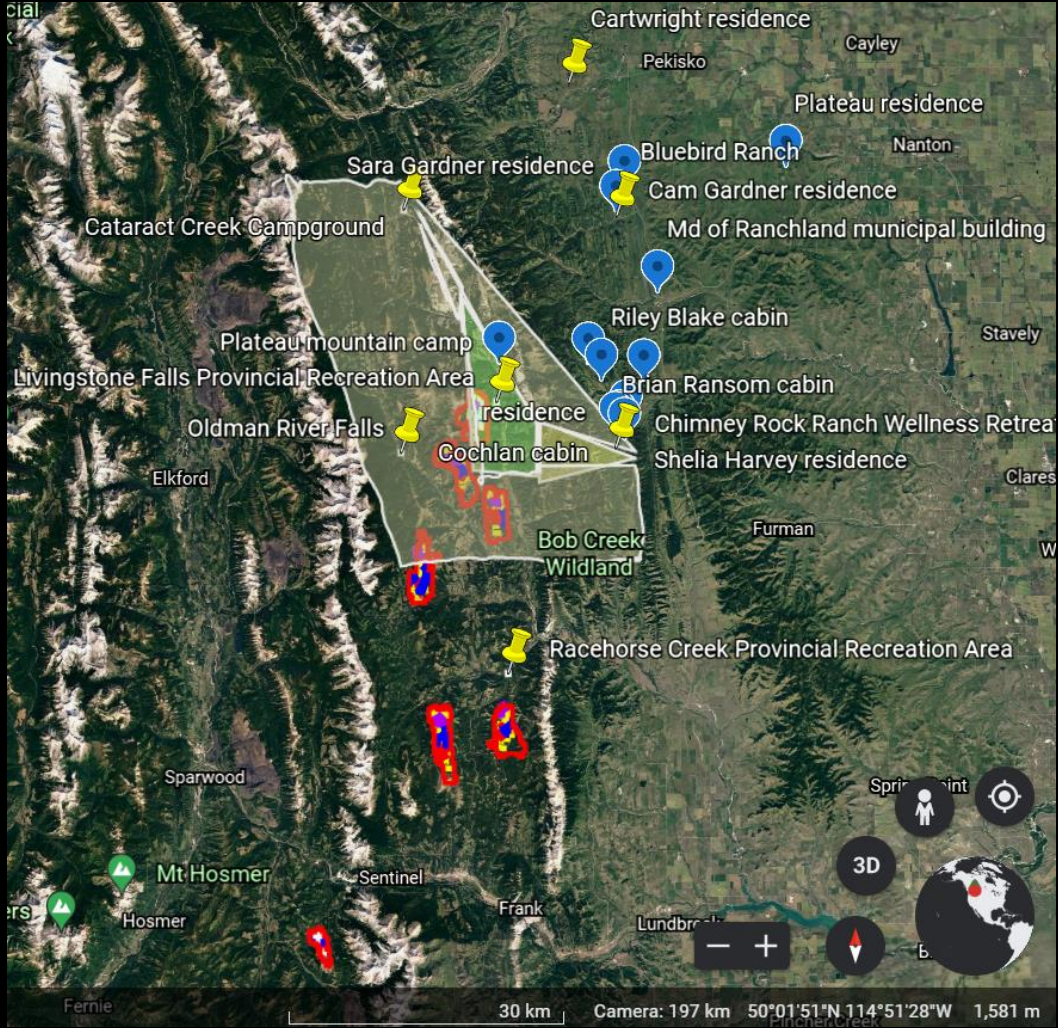
Project	Mine Ops Area Ratio	Equipment Operating Hours Ratio
Grassy Mountain	1.00	1.00
Tent Mountain Project	0.29	0.25
Elan Southth Coal Project	1.02	0.99
Isolation South	1.03	1.37
Cabin Ridge Project Ltd	1.03	0.99
Isola Coal Project	1.14	0.99
4-Stack Coal Project	0.99	0.99
Chinook (Vicary) Coal Project	1.07	0.99

Mine ops area scaled based on area of disturbance
Equipment operating hours scaled based on annual production

Step 2: Identify ratios to create mine plans with scaled air emission sources

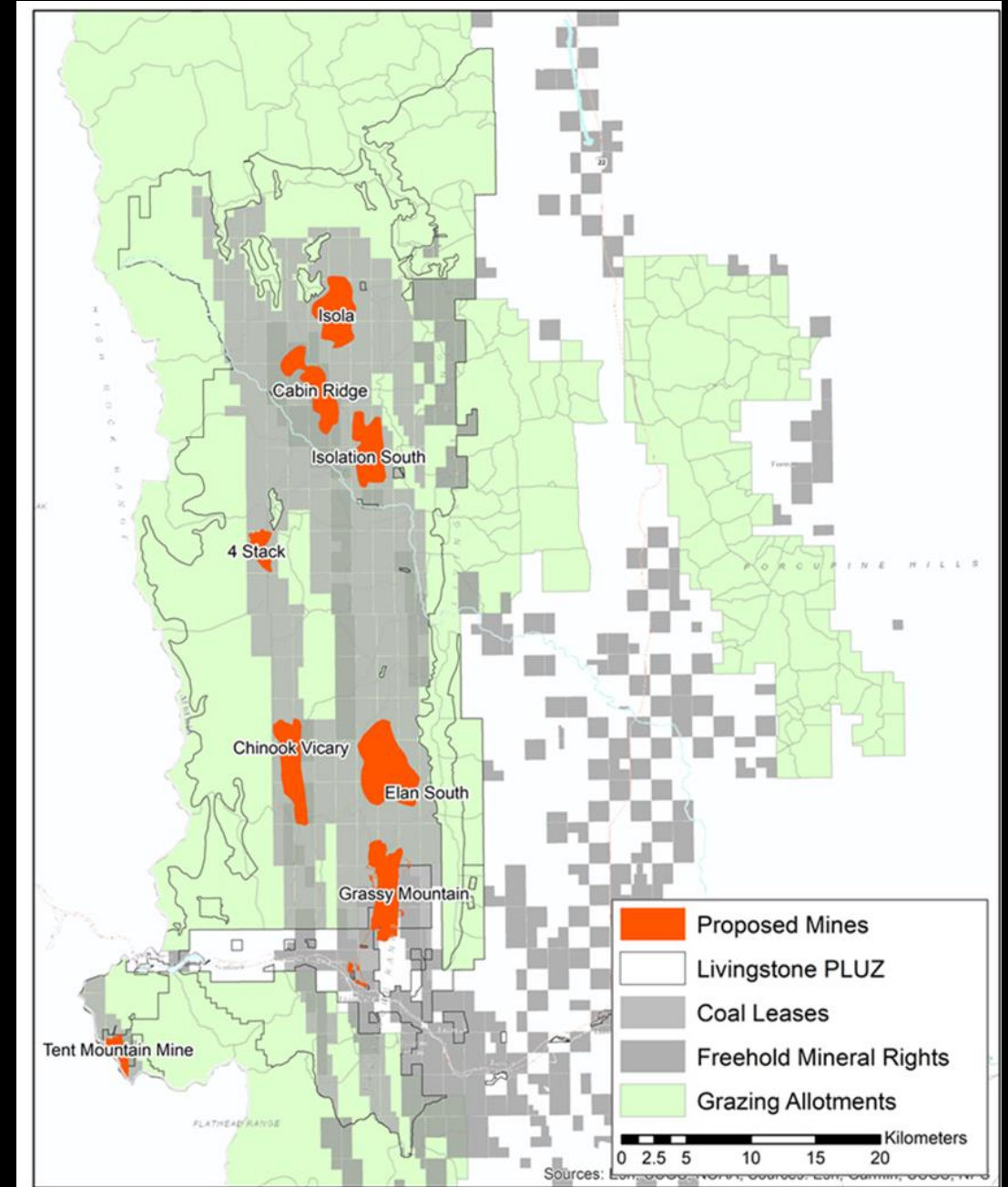


Step 3: Create a geospatial proposed development case (PDC) and cumulative CALPUFF model with 8 mines



Results and Next Steps

- Unbiased research on potential health risks of cumulative air impacts from planned coal mine development
 - Engage decision makers
 - Inform policy and regulations
 - Support liability risk- economic benefit analysis
- Publication August 29



Questions?

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